Discrete SD–ND linking transitions from the yrast superdeformed band in ^{194}Pb: J^{π} and E_x

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Twelve one–step linking transitions between the yrast SD band and low–lying states in ^{194}Pb have been identified, shown in Fig. 1. A further 12 high–energy transitions have also been identified to be in coincidence with the yrast SD band. Anisotropy measurements have determined that the linking decays include El, Ml and mixed M1/E2 transitions. $J^{\pi} = 6^{+}$, $E_x = 4878.4(3)$ keV and $J^{\pi} = 8^{+}$, $E_x = 5047.8(3)$ keV were unambiguously assigned to the two lowest lying observed superdeformed states without *a priori* assumptions about the properties of SD bands. These results represent the first experimentally self–consistent J^{π} assignments to an SD band.

The experiment was performed at the Lawrence Berkeley Laboratory 88-Inch Cyclotron Facility using the ^{174}Yb(^{25}Mg,5n) reaction at E(^{25}Mg) = 130 MeV and the GAMMASPHERE array [1]. The isotopically enriched (>98%) ^{174}Yb target was 1.21-mg/cm^2 thick, and was evaporated directly onto a 6.13-mg/cm2 Au backing. The signal-to-noise ratio of the SD primary γ rays is enhanced when a thick backing is used.

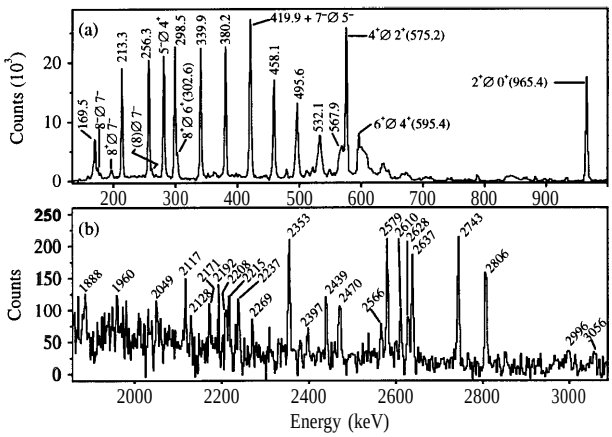

Figure 1: Triple-gated ^{194}Pb SD spectra.

21(2)% of the ^{194}Pb yrast SD band intensity has been observed to decay out through the one–step linking transitions. At first glance this is a surprisingly large proportion of the SD flux when compared to the ~5% observed for the ^{194}Hg yrast SD band [2]. However, arguments based on level density considerations at the point of SD decay, combined with the different low-lying ND structure of ^{194}Hg and ^{194}Pb indicate a more highly fragmented decay in ^{194}Hg is to be expected.

Greater understanding of these properties is anticipated with the improved resolving power of the "complete" GAMMASPHERE and EUROBALL arrays, for example, excited bands and their decay properties. Unique determination of the J^{π} and E_x values of SD bands are needed to place more stringent restrictions upon theoretical calculations which predict the SD states and their properties, in particular, the excitation energy of the SD bandheads. In addition, this knowledge will help to address the phenomena of "identical" bands.

References

[1] I. Y. Lee, *Nucl. Phys.* A520, 641c (1990).

[2] T. L. Khoo *et al., Phys. Rev. Letts. 76, 1583 (1996).*